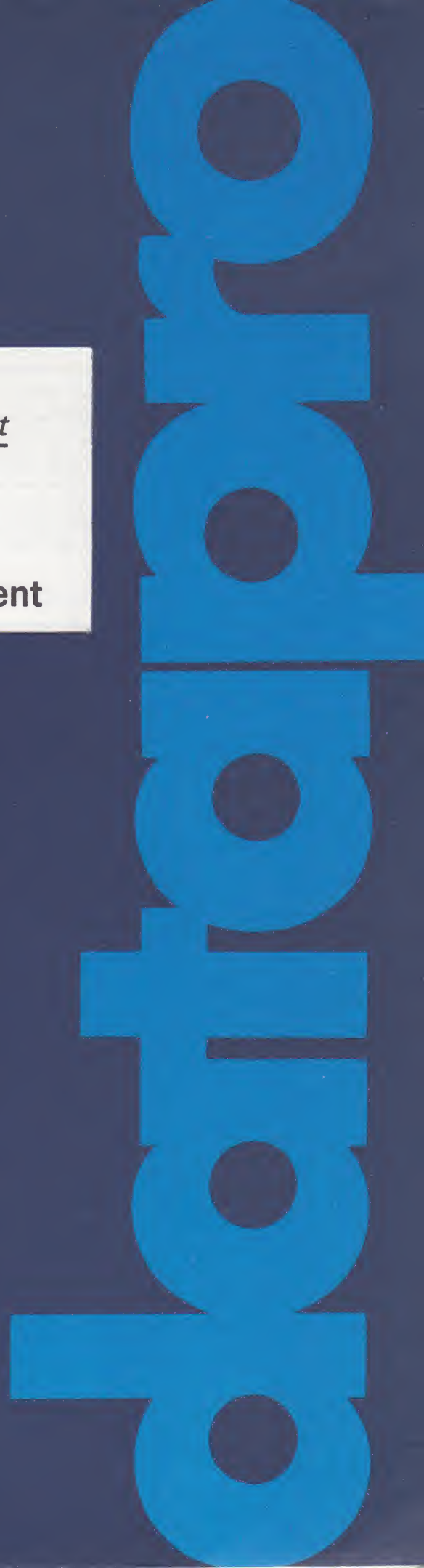


*A Datapro Feature Report*

**All About  
Data Collection Equipment**





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# All About Data Collection Equipment

In the course of responding to our subscribers' expressed interest in data collection systems and devices, Datapro had to draw some boundaries around the category. Otherwise, every device that records or transcribes data in any fashion would be a candidate for inclusion in the report. After all, there is little difference between a conventional card reader and a badge reader, except in the environmental and human engineering aspects. The desirability of being able to accommodate a thicker document (plastic card), the desirability of low cost, and the lack of need for high reading speed or stacker capabilities have produced badge readers that differ markedly from conventional card readers in practice, but the basic principles are the same. A card reader could be used as a badge reader, but it would definitely not be a practical choice.

The subject material of this report is circumscribed by two criteria:

- The equipment must be capable of accepting variable information manually entered by an operator.
- The equipment must not appear elsewhere in DATAPRO 70 as a type of device already reported on.

These rules largely exclude the wares of component manufacturers, computer peripheral equipment vendors (disk drives, tape units, card readers, OCR/OMR readers, etc.), key entry vendors (keypunches, key/disk systems, etc.), office equipment vendors (typewriters recording on cassette tape, word processing systems, etc.), and many computer terminal vendors (intelligent terminals, typewriter terminals, CRT's, etc.). Of these types of equipment, only mini-peripherals and office equipment are not covered in other places within the pages of DATAPRO 70. (Later on in this report we will get more specific about just where they *are* covered and whether they are viable alternatives to the equipment described in this report.) Mini-peripherals and office equipment are covered adequately in other Datapro reference services (*Datapro Reports on Minicomputers* and *Datapro Reports on Office Systems*, to be specific).

## Defining Our Terms

To examine the need that provided the impetus for the development of data collection equipment, we need to distinguish among three terms, all relating to converting data into a form that can be manipulated by a computer. Those three terms are *key entry*, *source data automation*, and *factory data collection*. In the younger, simpler days of data processing, when we were talking about bringing the power of the computer to bear on the problems of information management but before the majority of us had gotten around to actually doing it, these terms comprised the whole of the vocabulary concerning data preparation for the computer. Employing the precision available with hindsight, these terms meant:

Data collection is the catch-all phrase for data input devices normally used in environments other than computer data preparation areas. The equipment ranges from central recording systems for reporting attendance and work-in-progress information to hand-held tape recorders for inventory-taking. And there are some exotic devices in between. This report surveys the specialized equipment available from 31 vendors and summarizes users' experience with the most popular data collection systems.

- *Key entry*—That which was done in the keypunch room, although even then many users desired alternatives.
- *Source data automation*—Capturing data as the byproduct of a conventional business transaction. Optical character readers and/or recording typewriters that read or recorded documents as they were generated were seen to be the answer for eliminating the need for double keying of business information. This equipment was always thought of in terms of a clean office or store environment.



For those of you who remember when the Digitronics Port-A-Verter was the only portable terminal, this self-contained Infopac I from AzurData may seem more like a watch fob. It stores data in a semiconductor memory and transmits it to a central pooling station via an acoustic coupler unit.



## All About Data Collection Equipment



*It looks simple, and it is. The Wright Line Punch can produce any card code by simply depressing as many keys as required. It may not be fast, but it doesn't require anything but a tab card and an operator to produce computer input.*

- ● **Factory data collection**—Recording data as it happened on the shop floor. This was the “dirty” or industrial-environment equivalent to source data automation.

As is typical with maturing technologies, simple, generalized solutions were usually found to be impractical for addressing specific problems. Source data automation was replaced with point of sale (POS) and transaction processing (which creeps over into other areas as well). And POS was in turn fragmented into department/retail stores, supermarkets, fast food outlets, hotels, hospitals, etc., each with slightly different information entry and handling needs. This was the natural result of equipment makers, faced with the economic necessity of generating revenues, finding out that general solutions are great for learned papers and philosophical discussion but are inadequate for specific solutions. Specialization was inevitable.

Key entry, on the other hand, was already specialized. The changes in that area involved the development of new kinds of equipment to do the job cheaper and faster. In fact, there is reverse specialization occurring, with key entry equipment taking on some of the tasks traditionally assigned to the host computer.

Factory data collection shares with source data automation (POS) the need for highly human-engineered input stations, and it shares with key entry and POS the advantages of distributed processing (intelligent input stations). But in two ways it is unique. One has already been mentioned—the need to function reliably in adverse environments. The other is the lack of clerically oriented personnel to operate the input stations. The problem of getting a master machinist to enter data at an input station is radically different from getting a counter clerk to use a different kind of cash register. These two considerations—adverse environment and personnel—are just as important in the development of a data collection

system as is the information to be collected and the manner in which it is processed.

The term “factory data collection” unfortunately implies that it involves only shop floor data reporting. Just as the term “source data automation” could not for long completely summarize data collecting activities in stores or other business transaction locations, the term “factory data collection” inadequately summarizes the range of data collecting activities that can be grouped under its head. In general, this group includes all data collection occurring in an uncontrolled environment, whether it be a manufacturing area, a warehouse, or outdoors.

It is not possible to be entirely rigorous about categorization of product and application types. There is too much crossover in the application of technology and techniques. However, undaunted by the impossible, we will set up some categories to make the equipment covered in this report understandable. *Key entry* encompasses all of the conventional data preparation and entry tasks directly associated with the computer and the people who tend it. It includes keypunch and key/disk operations as well as terminal operations. Normally, the data entry process and people are not directly involved with a business transaction at the time of entry. *POS* includes those operations involving a business transaction where control of the transaction is an important function and the collection of data is a byproduct; frequently, such operations involve a money transfer, cash or credit. *Data collection*, then, includes those operations performed in an uncontrolled environment by the people responsible for doing the work being reported on, and the transactions do not normally involve money transfers. POS usually involves a transaction between a company and the public; data collection usually involves an internal company operation.

Narrowing the field in this manner leaves three general classes of equipment: 1) portable units to be carried to the point of information occurrence; 2) stand-alone devices that record data in a manner that enables it to be transferred to a computer at a later time, but are not portable; and 3) systems composed of multiple stand-alone devices feeding a central data recorder or computer directly.

### Why Collect Data?

The *reason* for collecting data is essentially the same regardless of the application or the equipment used. Information is required to enable management 1) to know what is going on, and 2) to make intelligent decisions about what to do next. Those decisions include making changes as well as letting things continue just as they are with the comforting assurance that things are proceeding according to plan.

If you can stand in one place and see everything that is going on and keep straight in your head how much raw material remains, who is working today, how much time each employee has spent on each job (and how that

## All About Data Collection Equipment

compares with previous jobs), the status of each job in house, the status of inventory of finished goods, how much has been shipped, how much remains to be shipped on each contract, etc., then you do not need any fancy collection equipment to record the elements of such data or information. If however, your manual reporting system consistently fails to let Purchasing know about the need for a raw material or component before the floor runs out, or if you find yourself with a warehouse full of widgets and a pile of orders for whatchamacallits, then you need to take a look at improving your information collection procedures.

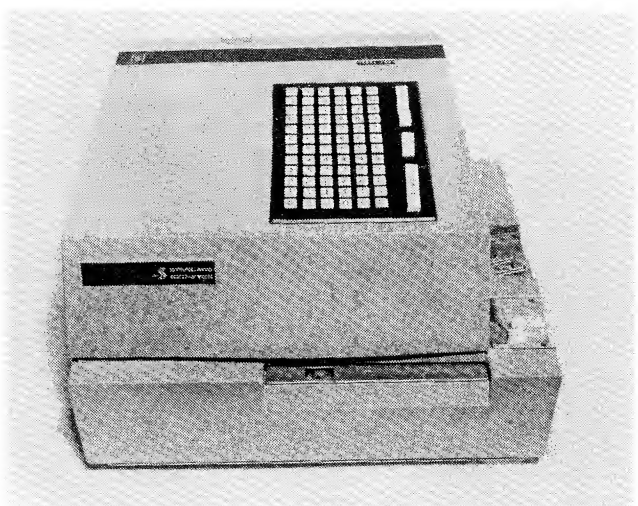
### Advantages of Automated Data Collection

The advantages of using automated recorders to gather data are threefold: 1) it is faster; 2) it is more accurate; and 3) it permits data processing equipment to be used in the analysis and reporting of information.

Speed is relative, and not necessarily a good thing in its own right. Each level of system enhancement implemented to increase the speed of data flow must be justified in terms of cost-effectiveness. In general, the faster information becomes available to managers, the more closely events can be controlled. Closer control can translate into reduced inventories and other efficiencies that mean direct savings in purchases and storage. But closer control can also translate into interference that upsets the smooth functioning of an operation. Which result you'll achieve depends on the quality of management you have and its adaptability to the new tools represented by improved information gathering. But managers have been coping with changes in techniques for a long time, and the previous statement should not be considered to represent an alarmist attitude. It merely reiterates the important point that improved equipment and tools provide the opportunity for enhanced performance but cannot guarantee it.

The accuracy of automated recorders stems from the reduction in the number of times data is transcribed manually. Magnetic tape recorders, semiconductor memories, optical wands, badge readers, keyboards, and all the other types of electronic/mechanical devices can and do introduce errors in a host of different ways. But just as the computer cannot (at present) exercise intuitive data perception and linking, the human cannot equal the transcription accuracy of these devices. Of course, the data is normally entered by the human as the first step, and cards can be inserted upside down or a wrong key depressed; but the subsequent transfers and manipulations of data are relatively free of transcription errors from that point on. As with speed, each implementation of a higher level of freedom from error carries with it costs which must be evaluated in terms of the cost of the error and the cost of alternatives.

The third advantage, permitting the use of data processing equipment, is really self-evident. You would not collect the data if you were not going to analyze it, and you



*The Standard Register Source Record Punch is, in essence, a considerably more sophisticated version of the portable Wright Line Punch in the preceding photograph. In addition to punching keyed data, it can also be attached to digital output devices such as scales to produce a permanent, readable record of events and values.*

would not put it in machine-readable form if you were not going to use machines to read it. (This statement excludes the whole area of reading environmental variables directly for process control, for security access control, and other automated control systems, as that area is outside the scope of this report.)

### Getting Down to Specifics

The general nature of the preceding discussion serves to set the stage for discussion of the specifics. (You can get a general article in the supplement to a Sunday newspaper for a quarter; Datapro intends to provide more than that.) The general discussion was necessary to prevent multitudinous exceptions and comments about the scope of the report.

There are two basic types of situations that occasion the recording of data. In one, a person in a fixed location observes occurrences that need recording as they pass his station. An example of this is reporting on work in progress. As each job order passes a particular point in manufacture, that information is recorded. The task location remains fixed and the information comes to it, so to speak. The second situation is where the job requires the person observing the information (and recording it) to move over a fairly wide area. Inventory taking is an example of this situation. It would be inconvenient, time-consuming, and costly to move all the inventory items past a fixed recording station each time you wished to take a count of what is in inventory. In this situation, the information remains fixed and the observer goes to it.

All data collection systems can be resolved into combinations of these two types of situations—but that resolution is not always simple. Part of the complication has to do with who performs the data recording. Take, for example, the work-in-progress reporting task mentioned above. If





## All About Data Collection Equipment

➤ the person doing the reporting is the operator of the fork-lift who physically moves the components under construction from point to point, is the operator or the information moving? If the production operation is geared to bringing different specialized teams to the component under construction, is the reporting performed at a fixed location by different personnel as they move into the area, or are portable recorders taken along with the moving teams, or is some combination of both used? Do you count parts as shipped, or do you count each day's beginning and ending totals and assume that the difference is the number shipped?

It should be clear by now that the overriding characteristic of data collection is not the particular equipment employed, but the information to be collected and the uses to which it is to be put. But that is an oversimplification. There is an interrelationship between the equipment available and the things that can be done. Without portable data recording devices, it would be pointless to discuss applications requiring them. Without centralized data recording systems, it would be pointless to discuss minute-to-minute information updating and analysis.

### Three Key Questions

This brings us to the point of being able to summarize the problem of data collection system design in terms of the answer to three interrelated questions:

- What do you want to do?
- What equipment is available to accomplish this?
- What compromises are required because of cost or equipment availability?

We approach a discussion of the first question with some trepidation, because it is very easy to tread on someone's toes. Every conceivable combination of committee, task force, specialist, vendor, consultant, relative, etc., has been used to ferret out the design parameters for an information system. Each approach has met with success—and each with failures. The first question is actually a shorthand way of summarizing a number of questions, such as: What information is needed? How is it going to be generated and who will enter it? Who will use it and what does he need to see? What is the time frame between the entry and use of information?

Regardless of the actual procedure you use for tying down the information reporting needs, sooner or later you have to get specific. Asking whether you should look at available equipment first or determine functional requirements first is like asking whether the chicken or the egg came first—there is no set answer. You must do both at the same time. Preliminary information and cost needs will to some degree place restrictions on the equipment that can fill those needs, and available equipment will suggest possible solutions to your problem.

One often-overlooked aspect of system design is system assurance. Whether the system is designed by in-house personnel, a consultant, or a vendor under a development contract, someone needs to have the responsibility for checking the final plans to make sure that all needs are met in a reasonable way. This takes extra time and personnel but should be a key part of any information system development project. System assurance personnel frequently need to display tact to avoid offending someone because his pet idea is not feasible. The usual manner of system implementation is to get input from all affected personnel before the system is finished. The tacit assumption is that since everyone has had an opportunity to comment, the final version will meet everyone's needs. While the process looks rather trite when set down on paper, in actual practice, it is anything but trite.

Another source of possible difficulty, closely related to system assurance, is the question of who is responsible for putting the system together. If the final system includes components from multiple vendors, then someone has to interface with those vendors to make sure that the various components are delivered on time and are indeed the ones ordered. This can be performed internally or by an external agent, such as a prime contractor, or even by the major vendor of components if he also assumes the responsibility for the system. In any case, make sure that someone does have the responsibility—and that he knows he has it.

### Equipment Considerations

The principal portion of this report is devoted to the available equipment. The comparison charts at the end of this report provide an overview of the various vendors and the products they market. The explanation of the comparison chart entries immediately preceding the charts contains a great deal of information about the various types of equipment. Here, let us only be concerned with some general comments on equipment style.

Perhaps the most basic question concerning equipment is whether the recording devices need to be portable or whether they can remain in a fixed location. Portable devices are normally tied into a system through communications links. Typically, a central recorder can poll a number of remote locations, using the telephone network. The only catch is that, if the portable device has not been returned to its cradle or the cassettes have not been loaded into the remote transmitter, the central receiver draws a blank. Fixed devices, barring malfunction, are always ready.

If your information needs are not time-critical, you can consider equipment that is not tied directly into a central system. The recorders, portable or fixed-location, record on some type of medium (punched cards, magnetic tape, etc.) that is hand-carried to the central processing facility. Advantages of recording accuracy are gained at the expense of timeliness.



## All About Data Collection Equipment

A second consideration having a significant effect on possible system design, assuming that direct connection is desirable, is whether one-way or two-way transmission is needed. One-way transmission permits the gathering of data at a central point. Two-way transmission permits instructions, inquiry responses, or other information to be returned to the input stations. If two-way transmission is decided upon, the type of display must be determined. Displays can be "soft" (such as a CRT or LED array) or "hard" (such as a printer), depending on whether or not you want a permanent copy.

Each of these advances in flexibility costs more, not only in terms of equipment, but also in terms of system development and programming. It is your problem to determine whether the flexibility that enables supervisors to make system inquiries about the status of particular jobs at many remote locations around a plant is a luxury or a necessity.

The environment in which the equipment will be called on to function is also an important factor that needs to be clearly spelled out to prospective suppliers. If you neglect to mention that your input station has to operate in the middle of a car wash, for example, then you will get a lot of proposals from vendors that are inadequate and will only waste both your time and theirs. Excluding toxic areas, machines are generally more sensitive to adverse environments than humans, so knowledge that people will be working in an area is no sure indication that special requirements for machines do not exist. One point of confusion involves the special environmental requirements for large computers, whereas small computers can function in a "typical office" environment. The fact is that large computers could function perfectly well in the same typical office environment, but they dissipate so much heat that without special air conditioning they would

soon convert that office environment to something approaching the Sahara Desert.

### What About Conventional Terminals?

Early in this report we set down the rules which we used for selecting the equipment to be included in this report. At that time, we mentioned the conventional data processing devices discussed in other places within DATAPRO 70. Virtually any device that can record or read data can be worked into a data collection system somehow, whether at the central recording site or at a remote input station. Therefore, nearly all of the equipment reports in DATAPRO 70 may be applicable, to one degree or another. There are two guides to the contents of DATAPRO 70. Near the front of Binder 1, there is a comprehensive, functional Index that lists all the reports by product type, vendor name, and product name. In addition, there is a detailed Table of Contents at the beginning of each binder, which lists all the reports in that binder. Other pertinent reports in DATAPRO 70 include the survey reports, such as this one, on particular classes of products (the "All About" report series).

Most of the equipment included in this report can be considered specialized, if for no other reason than the fact that you do not find these devices in the typical business data processing shop. In considering the implementation of data collection systems of the type discussed in this report, you may well wonder whether more conventional devices, and communications terminals in particular, could be used effectively to reduce the number of vendors involved and thus simplify the procurement task. The answer is yes, they can, except where environmental conditions prohibit their use. However, the nature of such devices generally indicates that they would be a poor choice because of the second unique characteristic of data collection systems mentioned early in this report—personnel considerations. ➤



*The Termiflex photographer has produced a clever bit of staging. Enclosed in the attache case is everything the modern businessman needs—a calculator, a personal dictating unit, an appointment book, and a computer terminal. Although not truly portable, the Termiflex HT/2 hand-held display unit has sufficiently powerful features to generate a great deal of interest at trade shows. A fully portable unit resembling the Termiflex, but with less sophisticated display features, is marketed by Telxon.*

## All About Data Collection Equipment

### USER RATINGS OF DATA COLLECTION EQUIPMENT

Equipment	No.of User Re- sponses	No.of Input Sta- tions	Environment*				User Ratings**																								Problems*					
			Office	Warehouse	Shop, clean	Shop, dirty	Overall Satisfaction					Ease of Input					Ease of Training					Hardware Reliability					Maintenance					Training	Reliability	Usability of info.	Environment	
Data Pathing	8	495	5	5	6	5	3.6	4	3	0	0	3.4	3	4	0	0	3.6	4	3	0	0	3.4	3	4	0	0	3.7	5	2	0	0	0	0	0	0	0
IBM 357	5	58	0	1	2	4	2.8	1	3	0	1	3.4	2	3	0	0	3.4	2	3	0	0	2.6	2	0	2	1	3.0	2	1	2	0	0	3	0	1	0
IBM 1030	10	279	1	2	7	4	2.9	1	8	0	1	3.2	4	4	2	0	3.2	2	8	0	0	2.8	2	5	2	1	2.9	2	5	3	0	1	3	0	3	0
IBM S/7-2790	8	103	0	1	4	4	3.3	3	4	1	0	3.5	5	2	1	0	3.4	3	5	0	0	3.5	4	4	0	0	3.3	3	4	1	0	1	3	1	1	0
IBM 3270***	4	193	4	2	3	3	3.3	1	3	0	0	3.8	3	1	0	0	3.8	3	1	0	0	3.3	1	3	0	0	3.3	1	3	0	0	0	0	0	0	0
Totals	35	1125	10	11	22	20	3.1	10	21	1	2	3.4	17	14	3	0	3.4	14	20	0	0	3.1	12	16	4	2	3.2	13	15	6	0	2	9	1	2	4

\* Response counts.

\*\* Response counts. Legend is E—Excellent; G—Good; F—Fair; P—Poor; WA—Weighted Average based on assigning equal weight to each user response and weights of 4 for Excellent, 3 for Good, 2 for Fair, and 1 for Poor.

\*\*\*The IBM 3270 CRT display is not normally thought of as a data collection device in the same sense as the other equipment mentioned, but the use environments and the applications which the users listed clearly indicated that they were using the 3270 in place of equipment like the other types listed here.

➤ General-purpose data communications terminals seldom have the necessary provisions for operator guidance unless extensive programming is done at the central site to generate prompting messages. Simple data entry in fixed formats without extensive prompting is feasible; but a complete typewriter keyboard may not convey the essential concept of simplicity to the personnel having to use it. Conventional data processing devices are normally keyed to high-volume production. Hunt-and-peck typing constitutes a misuse of such equipment. But it is possible to use conventional data terminals if your personnel will go along with the idea. There are many plant locations that provide an adequately clean environment for the operation of a CRT or typewriter terminal. Perhaps the greatest contrast between specialized and conventional devices occurs when using the input stations to record time and attendance information. Clearly, having each employee type in his name and/or employee number via a teleprinter keyboard cannot approach the efficiency or employee acceptance of simply inserting a badge and walking on.

#### User Experience

With high hopes, Datapro designed a detailed questionnaire on data collection equipment and included it in the March 1975 supplement to DATAPRO 70. By the editorial cutoff date of May 12, we had received a total of 99 returned forms containing information. Upon examining the returns, it became clear that many of our subscribers had confused the *collection* of data with the *processing* of collected data. Perhaps we did not make the questionnaire clear enough as to equipment types covered; perhaps our subscribers just wanted to respond anyway. (The support we have received from our subscribers in the

filling out and returning of our survey questionnaires has helped us immensely in making our reports better; for this we are indeed grateful. It has helped us, and it has helped you in turn.)

In any case, through careful sorting of the questionnaires, reading between the lines in doubtful cases, and plain guessing in a few others, we segregated the questionnaires into two stacks. In one stack we had a group of 56 Reader Survey Forms that appeared to deal with data collection equipment. In the second stack, we had the remaining 43 forms that appeared to deal with equipment that processed data after it had been collected by unspecified means (e.g., keypunch). Regretfully, we set aside the second stack as not applying to this report. Eagerly, we picked up the first stack of 56 forms and began sorting and tabulating the results. Regretfully, only five separate products received sufficient responses to merit individual mention. This information is presented in the accompanying table.

The questionnaires in this group, on the whole, were more completely and consistently filled out than any other group Datapro can remember seeing. We heartily thank those subscribers who took the time to fill them out and return them. However, the survey generated neither the response volume nor the diversity of responses to warrant tabulation beyond the information presented in the accompanying table—for which we are not apologizing by any means.

Included in the questionnaires was a smattering of responses on companies such as Control Data Corporation (Transactor) and Mohawk Data Sciences (Colorado Instruments C-Dek), which were early pioneers in data collec-

## All About Data Collection Equipment

tion systems but are no longer marketing that equipment. We received just two responses on the Singer System Ten, which has been marketed vigorously in the data collection field. And there were no responses on equipment from Sierra Research, North Electric, or Panasonic, all well-known names in the data collection field. Standard Register received just a couple of responses, and Addressograph-Multigraph none; both companies have long been active in the data collection market. The conclusion is obvious. We did not reach many of the users of this type of equipment. But the ones we did reach responded well.

### Equipment Characteristics

The accompanying comparison charts summarize the products of 31 vendors. The two sets of charts cover:

- Portable or stand-alone data capture devices; and
- Centralized data recording systems.

Beginning in March 1975, Datapro requested information by mail and telephone from more than 70 vendors known or believed to supply equipment for data collection applications. Some vendors responded that they produce components only and do not sell directly to end users. Some said they market only "conventional" data processing devices. Some we could not find. Some, despite repeated requests, failed to convey the necessary information to us in time to be included in this report. The net result is the comparison charts at the end of this report. They are as comprehensive as our best efforts could make them. The cooperation of the various manufacturers in the preparation of these charts is greatly appreciated.

The chart entries and their significance are explained in the following paragraphs.

### Portable and Stand-Alone Devices

The basic *type* or style of device is entered first. Three terms are generally used: hand-held, portable, or stand-alone. Hand-held indicates that the recording device is held in one hand while entering data. Normally, the other hand is occupied with depressing keys or handling an optical wand. Most of these devices, but not all, include recording provisions and an internal battery to permit portable operation free from an I/O or power cable. Some of the devices that use semiconductor memory as the data storage medium are able to contain the entire works in a single hand-held package; others that use a cassette recorder incorporate the batteries and recorder in a separate package hung from the belt or slung from the shoulder. A stand-alone unit is one that records data in machine-readable fashion but is not portable.

*Output media* identifies the basic means used for recording data or transferring it to the point where it is used. Some devices use semiconductor memory or a cassette recorder to record data locally, but use a communications line to transfer data. Usually, a separate device is

employed that includes the communications interface and control logic required for the data transmission operation; typically, the separate device is AC-powered although the associated input device is battery-powered. Again, typically, the input device includes a battery recharging circuit.

*Environmental orientation* identifies specific conditions under which the manufacturer indicates that each device can perform reliably. We specifically asked for recommendations as to suitability for the following environments: office, warehouse; high humidity; high temperature; corrosive atmosphere; dirty atmosphere; vibration; and electrical machinery. The latter environment—electrical machinery—frequently involves radio frequency interference (RFI) and magnetic fields of intensity sufficient to disturb some devices if brought too close. Manufacturers were less than candid in their replies to our environmental questions, probably because of the difficulty of determining what constitutes "high" temperature and humidity, etc. In any case, we reported the replies as presented by the manufacturers. If your environment is other than an office or clean warehouse, you had better question the vendor specifically to make sure there is no misunderstanding.

*Data input* describes how data can be entered into each device for recording. A wide range of device types is included in the charts, ranging from prosaic portable keypunches to exotic digitizers. The input methods are described in place wherever methods other than conventional numeric keyboards and such are employed. One method that is growing in use needs a little more explanation—the optical wand. Generally, these units resemble large ball-point pens and include circuitry for scanning a bar code to pick up fixed information such as product number. There are several different bar codes in use, including the Universal Product Code (UPC) as found on food items in grocery stores and codes devised by the manufacturers of the devices themselves. If you plan to use bar coding for data pickup, be sure to let any vendor know if you are already committed to a specific code. Changeovers can be tiresome, but are sometimes worthwhile.

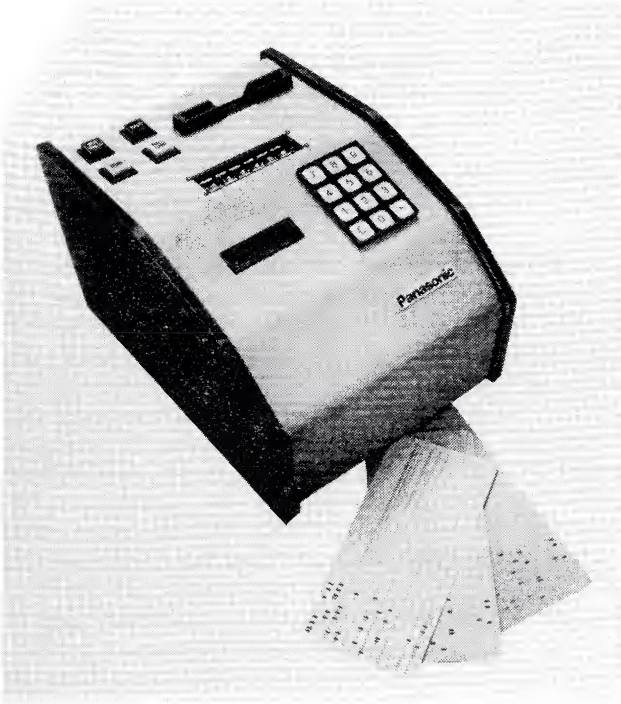
The remaining Data Input entries—quantity, character set, and data display—are self-explanatory within the chart.

The *physical properties* of the device are listed next, including size, weight, type of power supply, and approximate battery life if battery power is used. Most battery-operated units use rechargeable batteries. NiCad is a specific type of rechargeable battery.

Under *recording device*, the type and capacity of the recording device are listed. The "conversion" entry discusses the procedure for getting the data from the temporary semiconductor memory or cassette recorder into a form convenient for data processing. Typically, this is through a data communications link to a centrally located receiving station, which outputs the data onto



## All About Data Collection Equipment



*This Panasonic unit is in the classic mold of data collection equipment. It accommodates 80-column punched cards, permits key entry of variable numeric data, and provides a group of lever switches for semi-fixed numeric data.*

- ▷ half-inch magnetic tape, punched cards, or punched tape. Sometimes, the receiving station can be linked directly to a computer channel, or indirectly to the computer through a higher-speed communications link. Devices that record the collected data on punched cards or half-inch magnetic tape do not require conversion.

Because of the number of devices likely to be required, the *pricing* information is particularly sensitive. Where the manufacturer offers a lease arrangement, the information is stated; the manufacturers were asked to state the monthly rental rate for a two-year lease arrangement including maintenance. The cost for the converter, when separately priced, is also given. The converter price includes the local station only, and not a remote receiving station. The same comments apply to purchase price. Where a range is not given, the pricing information should be considered as representing a basic model without options.

### Data Collection Systems

This set of charts describes equipment that is typified by, but not restricted to, a group of input stations connected by cable to a central control component. The central control may include the capability for outputting data on computer-compatible media or it may be connected directly to the computer. In many cases, the central unit can do both. Other systems included in this group provide communications links with data recording devices, but provide substantially more logical capability than simple receiving stations.

The entries under *system arrangement* describe the configurational aspects of the system. The principal configuration characteristic is whether the system is self-contained (i.e., off-line) or connected to a host computer (i.e., on-line). Frequently, where the entry indicates both, the on-line mode is an additional capability of the system. The interconnection among the input stations and the central controller is described in basic terms. The type of connection (e.g., twisted-pair cable, 4-wire line/cable, communications link, etc.) is identified, along with the number of trunks or independent data paths where known.

A detailed description of the interconnection techniques is beyond the scope of this report, but they can be quite important. For example, the size of wire used will affect the maximum distance that an input station can be from the central controller because of the different electrical characteristics exhibited. The maximum distance allowed between an IBM 2791 Area Station and the central controller using #22 AWG outside-type telephone cable is 1000 feet; if #19 AWG cable is used, the maximum distance is 1750 feet. (Both of these distances are without extra-cost options for extending the distance.) If the connections are made using modems and communications links, distance becomes immaterial but operational speed becomes an important factor. In addition, the manner in which the connections are made may have an effect on promulgating equipment failures; i.e., if one input station goes down, others may be affected.

When evaluating configurational capabilities, do not forget to consider future growth. The growth can be accommodated by expanding one system or by installing multiple systems. Which you choose can have a decided effect on the equipment cost of your data collection system. Usually, but not always, expansion of a system is less expensive than installing multiple systems. Usually, there is no intercommunication between two input stations, nor any need for such. If there were such a need, it also could affect your expansion plans. The maximum number of stations per system and the maximum distance between controller and input stations is stated. Usually, the distance also applies between successive input stations, but that is also a function of the interconnection technique. The simplest way to handle that variable is to plan the locations where all your input stations should be and ask the vendors whether they can handle it.

The *environmental orientation* of the controller and the input stations is briefly described. It is not unusual for the central controller to be more sensitive to environment and require more gentle surroundings than the input stations. If you have unusual or adverse environmental considerations for the location of your input stations, be sure the vendors know about them in detail in advance. (Some consider anything beyond an office or warehouse to be adverse.)

The vendors may want to come out and see for themselves and even make some measurements. That's good. Some



## All About Data Collection Equipment

vendors have become somewhat skeptical after finding out that what was described as a "warm room" turned out to be next to a blast furnace. Be honest with the vendors when you request equipment and system proposals; it may raise the cost, but the chances are it will lead to getting the equipment you really need.

The converse of this applies as well. Some vendors may over-specify equipment to be on the safe side or for other reasons. If the vendor cannot explain to your satisfaction why each component has been selected, then the chances are he will not be able to install the system to your satisfaction. Don't hesitate to question the makeup of a system, and stay with it until you get a satisfactory answer.

The range of capabilities offered by the *input stations* is described in a series of entries summarizing the capabilities of all the available types of input stations. Usually, a modular range of capabilities is available either through a series of models or through options.

The entries are largely self-explanatory and consist of the sizes of fields or messages that can be entered in one set-up of the device. Some input stations use more rigid message formatting than others, with specific portions of the transferred messages reserved for special meanings. Others are more flexible and depend on programs stored in the central controller or host computer to set the message format.

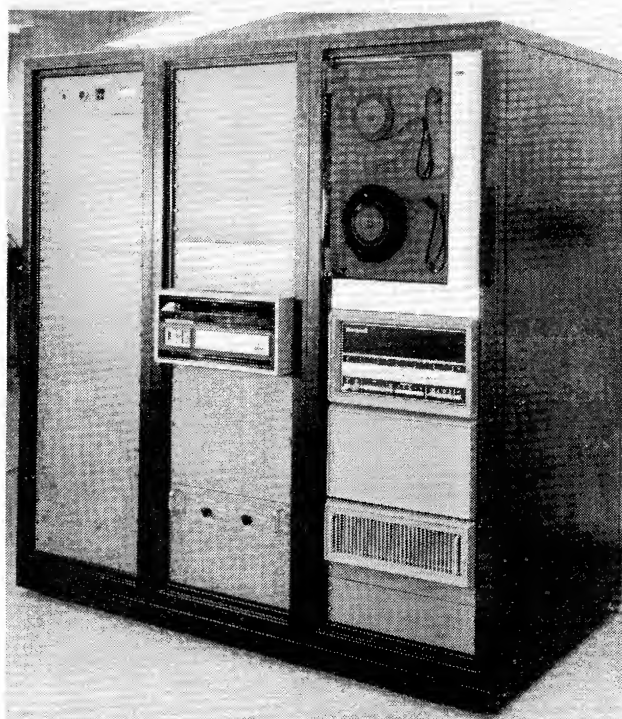
The entries under *central controller* identify the type of device used. Frequently, this is a minicomputer with extensive programming capabilities. The type and amount of storage available govern the size of the system that can be controlled and the degree of independence from the host computer, as well as the amount of processing you can do with the system by itself. The availability of disk and tape peripherals provides a back-up capability for accumulating data while the host computer cannot accept it because of system malfunction, special jobs running, or some other reason. These peripherals are also required to do any extensive amount of data processing with the system itself.

Space considerations make it impossible to identify specific software support or other peripheral devices available for the central controller. If the system is based on a minicomputer, then an assembler at the least and typically one or more higher-level language processors are likely to be available. In any case, the minimum support you can expect is I/O control routines that permit the generation of orderly files of data for presentation to the host computer. If the system operates in a free-standing mode, you will want to be sure that sufficient capabilities are present, in terms of language support and configuration possibilities, to meet your needs for analyzing the data and generating the kinds of action reports that prompted you to collect the data in the first place.

If the central controller is not a minicomputer, but a hard-wired device instead, then an answer of "limited" sometimes appears to the question of user programmability. If the controller presents options for message lengths and formats, style of time notation, and sequencing of guidance instructions, then it provides some of the same capabilities for which the stored program would be used in a minicomputer-based system, thereby justifying the "limited" entry.

*Pricing* is a nebulous term. Presented here are monthly rental costs (on a two-year lease arrangement, including maintenance) and purchase costs for the basic controller and input station equipment only. The final cost of a system will include development, programming, installation, employee training, project monitoring, and system monitoring and maintenance.

Many of the vendors specializing in data collection systems will undertake the whole task from system design through equipment selection, installation, and checkout, including any programming and employee training required. This is called a turnkey arrangement. At first glance, the costs for a turnkey contract may seem startlingly high. But when you begin evaluating the services offered and comparing their costs with the costs of providing the equivalent services within your own organization, you may change your mind. One advantage of a turnkey arrangement is that it gives you a single point of responsibility for the progress of the complete system implementation task. ➤



The central controller for Sierra Research Corporation's SDA-770 Factory Data Collection System resembles an ordinary minicomputer system except for the casework, perhaps. And indeed it is a minicomputer system. The differences are in the programming and in the types of peripherals it is intended to work with.

## All About Data Collection Equipment

### ➤ Manufacturers

Listed below, for your convenience in obtaining additional information, are the full names and addresses of the 31 vendors whose products are summarized in the accompanying comparison charts.

*Addressograph Multigraph Corporation*, Data Systems Division, 29100 Aurora Road, Solon, Ohio 44139. Telephone (216) 248-7930.

*AzurData Corporation*, 1305 Mansfield Avenue, Richland, Washington 99352. Telephone (509) 946-5161.

*Bourns Management Systems*, 6600 Jurupa Avenue, Riverside, California 92504. Telephone (714) 687-7220.

*Computer Identics Corporation*, 31 Dartmouth Street, Westwood, Massachusetts 02090. Telephone (617) 326-8960.

*Data Devices, International, Inc.*, 6301 DeSoto Avenue, Woodland Hills, California 91364. Telephone (213) 884-5500.

*Data Pathing, Inc.*, 370 San Aleso Ave., Sunnyvale, California 94086. Telephone (408) 734-0100.

*Data Systems Engineering*, a division of General Automation, 1620 East Ball Road, Anaheim, California 92805. Telephone (714) 535-2894.

*Datron Equipment, Inc.*, 100 Route 46, Mountain Lakes, New Jersey 07046. Telephone (201) 334-4521.

*F. P. Developments, Inc.*, 27 Cherry Avenue, Maple Shade, New Jersey 08052. Telephone (609) 779-0400.

*IBM Corporation*, Route 52, Dayton, New Jersey 08810. Telephone (201) 329-1000.

*Identicon Corporation*, 1 Kenwood Circle, Franklin, Massachusetts 02038. Telephone (617) 528-6500.

*Interactive Systems Inc.*, 3980 Varsity Drive, Ann Arbor, Michigan 48104. Telephone (313) 973-1500.

*Iomec, Inc.*, 3300 Scott Boulevard, Santa Clara, California 95050. Telephone (408) 246-2950.

*MSI Data Corporation*, 1381 Fischer Avenue, Costa Mesa, California 92627. Telephone (714) 540-6600.

*Nationwide Electronic Systems, Inc.*, 7N662 Route 53, Itasca, Illinois 60143. Telephone (312) 773-0370.

*Norand Corporation*, P.O. Box 666, Cedar Rapids, Iowa 52406. Telephone (319) 366-7611.

*North Electric Co.*, Electronics Division, P.O. Box 688, Galion, Ohio 44833. Telephone (419) 468-8100.

*Panasonic, M.E.C.A.*, Industrial Apparatus Dept., Industrial Division, 2960 Hart Drive, Franklin Park, Illinois 60131. Telephone (312) 451-1340.

*Science Accessories Corporation*, 970 Kings Highway West, Southport, Connecticut 06490. Telephone (203) 255-1526.

*Scope Electronics Inc.*, 1860 Michael Farraday Drive, Reston, Virginia 22080. Telephone (703) 471-5600.

*Sierra Research Corporation*, P.O. Box 222, Buffalo, New York 14225. Telephone (716) 632-8823.

*Singer Business Machines*, 2350 Washington Avenue, San Leandro, California 94608. Telephone (415) 357-6800.

*Source Information Systems, Inc.*, 1532 Third Street, Santa Monica, California 90401. Telephone (213) 394-0225.

*The Standard Register Co.*, Dayton, Ohio 45401. Telephone (513) 223-6181.

*Summagraphics Corporation*, 35 Brentwood Avenue, Fairfield, Connecticut 06430. Telephone (203) 384-1344.

*Telxon Corporation*, 3726 Dacoma Street, Houston, Texas 77018. Telephone (713) 686-8656.

*Termiflex Corporation*, 17 Airport Road, Nashua, New Hampshire 03060. Telephone (603) 889-3883.

*Texas Instruments, Inc.*, Digital Systems Division, P.O. Box 1444, Houston, Texas 77001. Telephone (713) 777-1301.

*Threshold Technology*, Route 130 & Union Landing Road, Cinnaminson, New Jersey 08077. Telephone (609) 829-8900.

*Wright Line*, 160 Gold Star Boulevard, Worcester, Massachusetts 01606. Telephone (617) 852-4300.

*Xebec Systems, Inc.*, 566 San Xavier Avenue, Sunnyvale, California 94086. Telephone (408) 732-9444. □

## All About Data Collection Equipment

## CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Addressograph Multigraph Corp. Data Recorders	AzurData Infopac I	AzurData Infopac II	Computer Identities PCP Portable Code Processor	Data Devices Micro Punch 461
TYPE	Stand-alone, portable	Hand-held, portable	Hand-held, portable	Hand-held, portable	Stand-alone, portable
OUTPUT MEDIA	Printed document; OCR or bar code	Communications line; RS-232C	Communications line; RS-232C	Magnetic tape cassette	80-col. cards
ENVIRONMENTAL ORIENTATION	Any	Normal office	Any; waterproof, dustproof, shock resistant	Office, warehouse,	Any
DATA INPUT Method	One or two embossed cards; up to 14 numeric slides; mark sense	Numeric keyboard; optical wand for universal identification codes	Keyboard; optical wand for universal identification codes; communications line	Optical wand for bar codes; numeric keyboard	8 slides for setting up field
Quantity	Up to 20 lines/14 digits	8 digits	15 or 30 digits	16-digit field	Up to 80; 8 per setting
Character set	Alphanumeric/numeric	16	16 or 20	Numeric	Numeric
Data display	Visual setting of slides	11-digit LED, including 3-digit record no.	18- or 33-digit LED, incl. 3-digit record no.	16-digit LED	Visual setting of slides
PHYSICAL PROPERTIES					
Size of input unit (w, d, h, inches)	Table top	4 x 9 x 2.625	4 x 9 x 2.625	12 x 4 x 8	13 x 9.5 x 4
Weight of input unit, pounds	—	2.5	2.5	7	8
Power supply	Manually operated	AC and/or self-contained NiCad batteries	AC and/or self-contained NiCad batteries	Self-contained rechargeable batteries	Manually operated
Battery life, approx. operational hrs.	—	8	8	4	—
RECORDING DEVICE					
Type	Printer	Semiconductor memory	Semiconductor memory	Cassette	Card punch
Capacity	Varies	4K to 64K digits	3.8K to 64K digits	67K digits	80 col.
Conversion	A-M bar code/mark readers; OCR scanner	Data transmission at up to 1200 bps via acoustic coupler	Data transmission at up to 1200 bps via modem or acoustic coupler	Data transmission at up to 1200 bps via modem	Not required
PRICING AND AVAILABILITY					
Monthly rental:					
Input unit	Contact vendor	—	—	—	—
Converter	Contact vendor	—	—	—	—
Purchase price:					
Input unit	Contact vendor	\$1,280 basic	\$2,450 basic	\$2,500 to \$4,000	\$595
Converter	Contact vendor	—	\$550 (comm. int.)	—	—
Date of first customer delivery	NA	1/75	9/73	1974	1967
Number in use	NA	NA	Over 300	NA	850
Serviced by	A-M	AzurData	AzurData	Computer Identities	Data Devices
COMMENTS	Wide variety of models available to input fixed data from plastic credit cards and/or variable numeric data	Unit designed for off-line data recording and on-line transmission to central receiver. Check digit and memory retention (aux. battery) optional	Unit permits 2-way data transmission; memory retention (aux. battery) optional	Other, non-portable models available for direct connection to computer or cassette recording	Unit interprets (prints) data on cards as punched

## All About Data Collection Equipment

### CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Datron Equipment 401	F.P. Developments, Inc.	Identicon Portapen 2	IBM 1001
TYPE	Stand-alone	Stand-alone	Hand-held, portable	Terminal
OUTPUT MEDIA	80-col. cards	80-col. cards	Communications line	Communications line
ENVIRONMENTAL ORIENTATION	Office, warehouse	Office, warehouse	Office, warehouse	Office, warehouse
DATA INPUT Method	Punched as entered	Keyboard; 80-col. plastic/tab card	Optical wand for UPC and other bar codes; keyboard	Reads first 22 col. of 22, 51, or 80-col. card; numeric keyboard
Quantity	7 digits	80 char.	12 digits	80 char.
Character set	Numeric	Alphanumeric	Numeric	Numeric or alphanum.
Data display	7 digits	None	12-digit LED	None
PHYSICAL PROPERTIES				
Size of input unit (w, d, h, inches)	NA	33 x 16 x 12	13.5 x 9.75 x 3.75	18.5 x 8 x 5
Weight of input unit, pounds	45	NA	9	21
Power supply	110 VAC	110 VAC	Self-contained rechargeable batteries	Derived from telephone
Battery life, approx. operational hrs.	—	—	8	—
RECORDING DEVICE				
Type	Card punch	Card punch	Semiconductor memory	None
Capacity	7 digits	500-card hopper	12K/20K/28K char.	—
Conversion	Not required	Not required	Data transmission at 1200 bps via separate unit	—
PRICING AND AVAILABILITY				
Monthly rental:				
Input unit	—	—	—	\$16
Converter	—	—	—	—
Purchase price:				
Input unit	\$1,850	\$4,500	\$2,895	\$535
Converter	—	—	NA	—
Date of first customer delivery	1970	1973	NA	NA
Number in use	100	20	NA	NA
Serviced by	Datron Equipment	Mfr. and customer	Identicon	IBM
COMMENTS		Three versions avail.: reader combining up to 2 cards for output; punch with remote inputs; keyboard punch	Company also produces Models 100 and 400 bar code scanners for fixed-station scanning of moving labels in factory or outdoors	



## All About Data Collection Equipment

## CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Iomec Portavert Model 40	MSI SOURCE 1100	MSI SOURCE 2000 Series	MSI SOURCE 2100
TYPE	Portable with cart	Hand-held, portable	Hand-held, portable	Hand-held, portable
OUTPUT MEDIA	Proprietary mag. tape cartridge; printer	Communications line	Communications line	Communications line
ENVIRONMENTAL ORIENTATION	Office, warehouse	Office, warehouse	Office, warehouse	Office, warehouse
DATA INPUT Method	Numeric keyboard; optical wand	Numeric keyboard	Numeric or alpha-numeric keyboard	Numeric keyboard; optical wand for MSI bar code
Quantity	15 dig. plus 5 fixed	15 digits	No limit	15 digits
Character set	Numeric	Numeric; 4 specials	Numeric or alphanum.	Numeric; 6 specials
Data display	Journal tape	10-digit LED	10-digit LED; strip printer	12-digit LED
PHYSICAL PROPERTIES				
Size of input unit (w, d, h, inches)	14 x 18 x 7.25	4.5 x 3 x 7.5	7.25 x 3.5 x 10.25	7.5 x 8.5 x 10.25
Weight of input unit, pounds	30	43	6	6
Power supply	Self-contained rechargeable batteries and AC	Self-contained NiCad batteries	Self-contained NiCad batteries	Self-contained NiCad batteries
Battery life, approx. operational hrs.	6 to 8	6	6	6
RECORDING DEVICE				
Type	Magnetic tape	Semiconductor memory	Mag. tape cassette	Mag. tape cassette
Capacity	87K digits	8K digits	60K char.	250K char.
Conversion	Data transmission via separate unit	Data transmission at 40 char./sec. via separate acoustic coupler	Data transmission at 40 char./sec. or 1200 bps via separate device with acoustic coupler or modem	Data transmission at up to 1350 bps via separate device with acoustic coupler or modem
PRICING AND AVAILABILITY				
Monthly rental:				
Input unit	—	Contact vendor	Contact vendor	Contact vendor
Converter	—	—	—	—
Purchase price:				
Input unit	Approx. \$2,000	\$1,360	\$1,135-\$2,100	\$1,270-\$2,200
Converter	Contact vendor	—	—	—
Date of first customer delivery	1972	1974	1972	1973
Number in use	5,000	1,000	13,000	10,000
Serviced by	Iomec	MSI	MSI	MSI
COMMENTS	Company produces a line of compatible peripherals including tape and disk drives, printers, punched card units, and punched tape units	MSI is a pioneer and leader in hand-held data recorders. The company has delivered about 30,000 units including models no longer manufactured. MSI's product line includes several central receiving stations for on- or off-line use with computers. Models include 2710/2720 for direct interface to IBM S/3 or S/360 (\$5,300 to \$5,850); 215 for off-line receiving on 7- or 9-track mag. tape (\$9,000); 280 for off-line receiving on 80- or 96-col. cards (\$7,500); 211 for off-line receiving on 8-level punched tape (\$8,160); and programmable 3040 (see Systems charts)		

## All About Data Collection Equipment

### CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Norand NT3/NT7 Series	Norand NT50 Series	North Electric PEC 7452	SAC Graf/pen GP3
TYPE	Stand-alone	Hand-held, portable	Stand-alone	Stand-alone
OUTPUT MEDIA	Communications line	Magnetic tape cassette	Philips cassette	Mag. tape; cassette; punched tape; others
ENVIRONMENTAL ORIENTATION	Office, warehouse, high humidity, dirty or corrosive atmosphere	Office, warehouse, high humidity, dirty or corrosive atmosphere	Adverse environment	Any
DATA INPUT Method	Keyboard	Keyboard; optical wand for bar codes	Badge; 80-col. cards; manual entry	Hand-held pen identifies point on paper; position is digitized to give a pair of 8-bit coordinates
Quantity	Up to 14 digits	Up to 14 digits	31 or 60	Unlimited
Character set	Numeric	Numeric	Numeric; 6 alpha.	As programmed in host computer
Data display	Up to 14 digits LED	Up to 14 digits LED	Matrix printer	Custom
PHYSICAL PROPERTIES				
Size of input unit (w, d, h, inches)	13 x 13 x 4	NA	12 x 12 x 14	Up to 72 x 72
Weight of input unit, pounds	25	5.4	50	NA
Power supply	120 VAC	Internal rechargeable batteries	117 VAC	Custom
Battery life, approx. operational hrs.	—	6	—	—
RECORDING DEVICE				
Type	Semiconductor	Mag. tape cassette	Mag. tape cassette	Custom
Capacity	4K or 8K digits	NA	76K char.	—
Conversion	Data transmission at 1200 bps via acoustic coupler or modem	Data transmission at 1200 bps via console and acoustic coupler or modem	Separate cassette to 0.5-in. tape or disk; data transmission	—
PRICING AND AVAILABILITY				
Monthly rental:				
Input unit	Contact vendor	Contact vendor	\$94	Contact vendor
Converter	Contact vendor	Contact vendor	\$42 (adapter)	Contact vendor
Purchase price:				
Input unit	Contact vendor	Contact vendor	\$2,585	Contact vendor
Converter	Contact vendor	Contact vendor	\$1,200 (adapter)	Contact vendor
Date of first customer delivery	NA	NA	12/70	NA
Number in use	NA	NA	NA	NA
Serviced by	Norand	Norand	Local	SAC
COMMENTS	Designed for order entry. Check digit feature is optional	Designed for order entry. Check digit feature is optional	Designed for time/attendance and labor distribution reporting	Digitizer can be incorporated in custom units for data entry by "pointing at" data symbol; decoding of coordinate data to get alphanumeric data is required

## All About Data Collection Equipment

## CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Source Information Systems Selectapunch	Standard Register Source Record Punches	Summagraphics HW-1/HW-2	Telxon data-Kap 919
TYPE	Stand-alone, portable	Stand-alone	Portable, stand-alone	Hand-held, portable
OUTPUT MEDIA	80-col. cards	80-col. card; Zipcard tab-size form set	Mag. tape, cassette, cart.; punched cards, tape; comm. line	Philips cassette
ENVIRONMENTAL ORIENTATION	Office, warehouse, high humidity/temp.; mech. vibration	Office, warehouse, factory, hospital	Any	Office, warehouse, high humidity, vibration, elec. mach.
DATA INPUT Method	6-digit numeric field set up via slides; punches and prints data	Reads 80-col. cards; internal slides for fixed data; columnar keyboard; clock; badge reader; scales; other digital devices	Overlay on board has picture of data keyboard; position of stylus is digitized and converted to char. code	Numeric keyboard
Quantity	80 col.	80 char.	Variable	12 digits
Character set	Numeric	Numeric (alpha. read)	Variable	Numeric, 3 alpha.
Data display	Slides; printed data	Prints numeric data	NA	12-digit Panaplex
PHYSICAL PROPERTIES				
Size of input unit (w, d, h, inches)	Table top	19 x 17 x 12.5	11 x 11 to 36 x 48	NA
Weight of input unit, pounds	NA	80	NA	7.9
Power supply	Manually operated	115 VAC	NA	Self-contained NiCad batteries
Battery life, approx. operational hrs.	—	—	—	6 to 8
RECORDING DEVICE				
Type	Card punch	Card punch	Any	Mag. tape
Capacity	6 dig. per field	80 col.	—	70K char.
Conversion	Not required	Not required	—	Data transmission at up to 1200 bps via acoustic coupler or modem
PRICING AND AVAILABILITY				
Monthly rental:				
Input unit	—	\$68 to \$290	—	\$70
Converter	—	—	—	—
Purchase price:				
Input unit	\$495	\$1,800 to \$5,725	Contact vendor	\$1,855
Converter	—	—	Contact vendor	—
Date of first customer delivery	NA	1966	4/73	3/74
Number in use	NA	Over 7,000	1,500	4,000
Serviced by	SIS	Standard Register	Summagraphics	Telxon
COMMENTS	Company also has product line for punching/printing fixed data from embossed plastic templates	12 different models in product line		911 Receiver (\$600/mo.; \$16,600 purch.) can poll multiple terminals automatically, pool data on 800/1600 bpi tape, and transmit to host computer

## All About Data Collection Equipment

### CHARACTERISTICS OF PORTABLE AND STAND-ALONE DEVICES

MANUFACTURER AND MODEL	Termiflex HT/2	Wright Line 2600/2610/2620	Wright Line 2629-29	Wright Line 2611/2621	Xebec Systems Alphabec-75
TYPE	Hand-held	Stand-alone, portable	Stand-alone, portable	Stand-alone	Stand-alone
OUTPUT MEDIA	Cable or comm. line; RS-232C or current loop	20 to 80-col. tab and plastic cards; see Comments	80-col. cards and some sets; thin plastic	20-col. (2611) or 22- and 80-col. plastic cards	Philips cassette; floppy disk
ENVIRONMENTAL ORIENTATION	Office, industrial, RFI	Normal environment	Normal environment	Normal environment	Office, warehouse
DATA INPUT Method	Alphanumeric data keyboard using 4 cases; 1000-char. memory	12-key keyboard; 1 for each card row; multi-key depression permitted	Selector dial with char. set equivalent to IBM 29/129 keypunches	12-key keyboard, 1 for each card row; multi-key depression permitted	Proprietary ball-point pen device; hand-print motions are translated to data codes
Quantity	NA	20 to 80 char.	80 char.	20, 22, or 80 char.	No limit
Character set	Alphanumeric	Any	Alphanumeric	Any	Numeric, some alpha
Data display	20 char. LED	None	Prints on card	None	96 char.
PHYSICAL PROPERTIES					
Size of input unit (w, d, h, inches)	2 x 4.25 x 7	18 x 4 x 5	18.5 x 8 x 6.25	18 x 5 x 10.5	22 x 17 x 6.5
Weight of input unit, pounds	1.5	8.5 or 12	16	30	25
Power supply	AC	Manually operated	Manually operated	115 VAC or 220/240 VAC, 50/60 Hz	AC
Battery life, approx. operational hrs.	—	—	—	—	—
RECORDING DEVICE					
Type	Semiconductor memory	Card punch	Card punch	Card punch	Cassette, floppy disk
Capacity	1000 char.	80 col.	80 col.	80 col.	145K or 243K char.
Conversion	Data transmission at up to 1200 bps via acoustic coupler or modem	Not required	Not required	Not required	Self-contained communications unit
PRICING AND AVAILABILITY					
Monthly rental:					
Input unit	—	—	—	—	\$240
Converter	—	—	—	—	—
Purchase price:					
Input unit	\$1,570 to \$2,300	\$285 to \$665	\$550 to \$595	\$1,195 to \$1,280	\$4,300
Converter	—	—	—	—	—
Date of first customer delivery	6/74	1962	1967	1968	6/75
Number in use	200	About 14,000	Over 5,000	Over 1,000	—
Serviced by	Termiflex	Wright Line (by mail)	Wright Line (by mail)	Wright Line (by mail)	Xebec
COMMENTS	HT/1 is available with 10-character display and 500-character memory for \$1190; minimum order is 50 units	Units handle 80, 51, and 22-col. cards/sets (2600); 20-col. plastic cards (2610); 22 and 80-col. plastic cards (2620)			Prices exclude cassette or floppy disk units; comm. is IBM BSC or asynchronous



## All About Data Collection Equipment

## CHARACTERISTICS OF DATA COLLECTION SYSTEMS

MANUFACTURER AND SYSTEM NAME	Bourns Management Systems	Data Pathing, Inc. System 150	Data Systems Engineering Model 2801	IBM 2790 (stand-alone)	IBM 2790 (on-line)
<b>SYSTEM ARRANGEMENT</b> Connection to main computer	Off-line/stand-alone	On- or off-line	On-line	Stand-alone (S/7)	On-line to IBM 360/370
Off-line output	9-tk., 800/1600 bpi magnetic tape	7- or 9-track magnetic tape	—	—	—
Interconnection	1 to 4 communications lines	2-wire direct or communications line	4-wire direct or communications line	500 kbps 2-wire lines to area sta.; 40 cps 2-wire lines to input sta.	500 kbps 2-wire lines to area sta.; 40 cps 2-wire lines to input sta.
Maximum input stations per system	No fixed limit	225	63 per line	512	1024
Maximum distance between controller and input stations, feet	Communication via modem	12,000 feet or via modem	2000 feet direct or via modem	1000 or 6000 to area sta.; 1000 to input sta.	1000 or 6000 to area sta.; 1000 to input sta.
<b>ENVIRONMENTAL ORIENTATION</b> Controller	Office, warehouse, high humidity, factory	Office, warehouse, factory	Computer room	Office	Office
Input stations	Office, warehouse, factory	Office, warehouse, factory	Factory floor	Industrial, except dirty, corrosive, or electromag. environment	Industrial, except dirty, corrosive, or electromag. environment
<b>INPUT STATIONS</b> Prepared data input: 80-column card Badge, 15/22-column punched Optical wand, bar code Transaction codes Fixed data	Punched or hand — — — —	22 or 80 col. 10 digits No User request User defined	80 col. 10 or 22 digits No User defined —	80 char. (2791); 10 digits (2796/2797) 10 digits (2791/2796/2797) — 1 digit (2791); 4 digits (2796); 2 (2797) —	—
Variable data: Columnar numeric keyboard 10/12-key numeric keypad Alphanumeric keyboard Lever switches Rotary switches Other types of data entry	— — — — — —	— 16 or 32 digits/field 16 or 32 char./field — — —	— — 28-key Up to 18 digits — 19-key function keyboard; relay I/O	— 6 digits per field (2791/2797) 16 digits (2798) 4 digits (2796) — Pulse counters	—
Operator guidance	—	Tutorial; back-lighted mask	Through function keyboard	31 (2791) or 48 (2798) backlit instruction displays	—
Data display	—	16 or 32 char./field	16 alphanumeric LED	Lever switches (2796); 6 digits (2791/2796); 16 char. (2798)	—
Automatic entry clear after transfer?	Yes	Yes	NA	Yes	—
Max./min. message length, digits/chars.	1 to 160 char.	1920 char. max.	NA	As programmed	—
Mixed message lengths permitted?	Yes	Yes	NA	Yes	—
<b>CENTRAL CONTROLLER</b> Model number Type Programmable by user? Storage	Bourns Minicomputer Yes 8K bytes core	150-30/-60 Minicomputer Yes 256K bytes core; 120M bytes disk	GA SPC/16, etc. Minicomputer Yes Varies	IBM System/7 Minicomputer Yes Semiconductor memory; disk	2715 Processor Limited 16K or 32K char. control storage
Time/date	Standard	Standard	Optional	Optional	Optional
<b>PRICING AND AVAILABILITY</b> Monthly rental (two-year lease, including maintenance): Controller Input Station Purchase price: Controller Input Station	\$1,000-\$1,300 (3-yr.) \$250-300 (3-yr.) \$30,000-\$35,000 \$7,500-\$8,000	Contact vendor Contact vendor Contact vendor Contact vendor	2.54 to 3.6% of purchase price Contact vendor \$2,800-\$9,775	— \$130-360 (area sta.); \$27-96 (2796/7/8) — \$6,180-\$15,800 (area sta.); \$1,160-\$4,400 (2796/7/8)	\$1,675-\$2,300 \$79,100-\$109,000
Date of first customer installation	4/74	1973	NA	NA	NA
Number installed to date	200	20-25 systems	NA	NA	NA
Serviced by	Bourns	Data Pathing	General Automation	IBM	—
<b>COMMENTS</b>	Auto. poll of remote locations; auto. dial and transmit to central computer; remote terminals are OMR 160 optical mark readers	Company specializes in turnkey source data management systems. Company has installed 150 earlier-model systems	2801 terminals are highly modular & can be interfaced to any computer; DCAM software support for GPC/16 costs \$3,000	Prices are for month-to-month lease. Configuration is complex. Controller connects to multiple area stations, to which input stations are attached; 2791 functions as both an area station and input station; 2793, as area station only. Remote connection between area stations and controller is possible	—

## All About Data Collection Equipment

### CHARACTERISTICS OF DATA COLLECTION SYSTEMS

MANUFACTURER AND SYSTEM NAME	IBM 1030	IBM 357	Identicon 600 Series	Interactive Systems VIDEODATA	MSI Data System IV Model 3040
<b>SYSTEM ARRANGEMENT</b>					
Connection to main computer	On- or off-line	Off-line	On-line	On- or off-line	On- or off-line
Off-line output	80-col. cards	80-col. cards	—	Magnetic tape	9-track 800 or 1600 bpi mag. tape
Interconnection	2-wire cable or communications link	Multiwire cables	2 twisted-pair cables per terminal and to computer	Sgl. broadband, coax, cable loop connects all units thru TDM RF 2-way mpxr. 256 per ch.; 200 ch. 60,000	Up to 4 communications lines
Maximum input stations per system	24 per line	20	16		4 at a time
Maximum distance between controller and input stations, feet	Up to 30,000	NA	2000		40 (local terminals)
<b>ENVIRONMENTAL ORIENTATION</b>					
Controller	Office	Office	Office, warehouse	Office	Office, warehouse
Input stations	Industrial, except dirty or corrosive environments	Industrial, except dirty or corrosive environments	Office, warehouse	NEMA 12	Office, warehouse
<b>INPUT STATIONS</b>				See Comments	
Prepared data input:					
80-column card	80 char.	80 char.	—	—	—
Badge, 15/22-column punched	10 digits	10 digits	—	—	—
Optical wand, bar code	—	—	20 digits	—	15 digits
Transaction codes	—	—	—	—	As programmed
Fixed data	—	—	—	—	—
Variable data:					
Columnar numeric keyboard	—	—	—	—	—
10/12-key numeric keypad	—	—	12 digits	—	15 digits
Alphanumeric keyboard	—	—	—	—	15 chars.
Lever switches	12 digits	6, 9, or 12 digits	—	—	—
Rotary switches	—	—	—	—	—
Other types of data entry	Up to 12 digits via special Data Cartridge	Up to 12 digits via special Data Cartridge	—	—	—
Operator guidance	Thumbknob scroll for written instructions for set-up	None	Audible beep for valid read by wand	—	—
Data display	None	None	12-digit LED for keyboard data	—	—
Automatic entry clear after transfer?	Yes	Yes	Yes	—	—
Max./min. message length, digits/chars.	NA	NA	20	—	As programmed
Mixed message lengths permitted?	NA	NA	Yes	—	Yes
<b>CENTRAL CONTROLLER</b>					
Model number	1034 (off-line)	358	635	300	3040
Type	Hard-wired	Hard-wired	Microprocessor	Minicomputer	Minicomputer
Programmable by user?	Limited	Limited	No	Yes	Yes
Storage	None	None	None; multiplexor	4K char. up	8K to 24K words of memory; mag. tape
Time/date	Optional	Optional	No	—	Yes
<b>PRICING AND AVAILABILITY</b>					
Monthly rental (two-year lease, including maintenance):					
Controller	\$389-\$557	\$83	—	\$950	Contact vendor
Input Station	\$27-\$216	\$30-\$77	—	\$75-\$150	Contact vendor
Purchase price:					
Controller	\$19,500-\$27,151	\$2,880	\$2,865	\$19,000	\$18,190-\$28,000
Input Station	\$1,110-\$10,647	\$1,040-\$2,980	\$900	\$750-\$10,000	\$1,360-\$2,200
Date of first customer installation	NA	NA	5/75	2/72	1973
Number installed to date	NA	NA	—	14 systems	150 systems
Serviced by	IBM	IBM	Customer/Identicon	Negotiable	MSI
<b>COMMENTS</b>	Off-line sys. can accommodate 1 line; on-line sys. can incl. printers at remote locations. Each input sta. above can accommodate 4 satellite badge readers	No longer being manufactured; controller does not include 24/26 keypunch	Interface to computer is RS-232C or local or remote 20-ma current loop	Wide range of conventional & specialized devices can be connected; prices above are for station interfaces; TV, data, & audio can be handled	Input stations are MSI hand-held recorders; see preceding Devices charts

## All About Data Collection Equipment

## CHARACTERISTICS OF DATA COLLECTION SYSTEMS

MANUFACTURER AND SYSTEM NAME	NES Chronologger	North Electric System 700	Panasonic Model B/BT/C	Scope Inc. VDETS 1000
<b>SYSTEM ARRANGEMENT</b>				
Connection to main computer	On- or off-line	On- or off-line	On- or off-line	On- or off-line
Off-line output	Mag. tape cassette; punched tape	Tape or disk	Any RS-232C device	Mag. tape; cassette; punched tape
Interconnection	Single 2- or 4-wire bus	2- or 4-wire	2- or 4-wire, direct or via modems	1 to 4 lines; cable or FM link
Maximum input stations per system	100	Unlimited	No practical limit	1 per line
Maximum distance between controller and input stations, feet	5000 or more	15,000 or more	3000 at 1200 bps	500
<b>ENVIRONMENTAL ORIENTATION</b>				
Controller	Any	Office, warehouse	—	Industrial
Input stations	Any	Adverse environment	Adverse environment	Any
<b>INPUT STATIONS</b>				
Prepared data input:				
80-column card	—	10, 22, 52, 80	10 or 22	Opt.
Badge, 15/22-column punched	10 digits	10, 15, 22	10 or 22	Opt.
Optical wand, bar code	—	—	—	—
Transaction codes	18 digits	Per customer spec.	—	User specified
Fixed data	—	Per customer spec.	2-digit terminal ID	User specified
Variable data:				
Columnar numeric keyboard	—	Up to 20 col.	—	—
10/12-key numeric keypad	Up to 18 digits	—	12 digits (Model C)	Opt.
Alphanumeric keyboard	—	—	—	—
Lever switches	Up to 20 digits	Up to 20 digits	6 digits (Model C)	—
Rotary switches	—	—	—	—
Other types of data entry	—	Heat sensors, counters, switches, etc.	—	Voice
Operator guidance	None	—	—	Visual display or audio response prompting
Data display	LED	Matrix printer	4-digit time (Model BT); 12-digit LED (Model C)	2-digit hex LED; 16-char.
Automatic entry clear after transfer?	Yes	No	Yes	Yes
Max./min. message length, digits/chars.	70 char.	1 to 120 char.	17 to 49	User specified
Mixed message lengths permitted?	—	Yes; not recommended	No	Yes
<b>CENTRAL CONTROLLER</b>				
Model number	NES	C700	Not required	VDETS 1000
Type	Hard-wired	Minicomputer	—	Minicomputer
Programmable by user?	Limited	Yes	—	Yes
Storage	Magnetic tape cartridge, disk, punched tape	Disk, tape; per customer requirements	—	16K to 64K bytes core; disk; mag. tape; cassette
Time/date	Optional	Std. in input station	Standard	Standard
<b>PRICING AND AVAILABILITY</b>				
Monthly rental (two-year lease, including maintenance):				
Controller	—	\$300-\$900	Contact vendor	—
Input Station	—	\$50-\$150	Contact vendor	—
Purchase price:				
Controller	\$4,000-\$10,000	\$7,000-\$15,000	Contact vendor	\$12,000
Input Station	\$2,500-\$5,000	\$1,500-\$3,500	Contact vendor	\$3,200
Date of first customer installation	NA	NA	NA	7/75
Number installed to date	NA	NA	NA	12 (prev. model)
Serviced by	NES	North Electric	Panasonic	Computer Services Support Corp.
<b>COMMENTS</b>		Company provides custom-tailored systems; above is a typical arrangement	Units operate in contention mode on multipoint line	Translates spoken, discrete words to ASCII data codes by encoding the analog signal & comparing patterns with previously recorded patterns by the same speaker

## All About Data Collection Equipment

### CHARACTERISTICS OF DATA COLLECTION SYSTEMS

MANUFACTURER AND SYSTEM NAME	Sierra Research SDA-770	Singer System Ten	Standard Register LCT Series	Texas Instruments DSX Data Exchange System	Threshold Technology VIP 4000
<b>SYSTEM ARRANGEMENT</b>					
Connection to main computer	On- or off-line	Stand-alone	On- or off-line	On- or off-line	On- or off-line
Off-line output	Magnetic tape	—	80-col.card;Zipcard tab card sets	9-tk, 800/1600 bpi tape	Standard periph.
Interconnection	Local cables; remote via modems	Twisted pair lines	Twisted wire pair; modem	Twisted pairs or via modems	2-wire cable or radio link
Maximum input stations per system	256	190	1	64 to 256	Up to 100
Maximum distance between controller and input stations, feet	10,000 (local)	Up to 8 wire miles	2000 (twisted pair)	10,000 (twisted pair)	Variable
<b>ENVIRONMENTAL ORIENTATION</b>					
Controller	Computer room	Office	—	Office	Factory
Input stations	Factory	Any	Office, warehouse, factory, hospital	Warehouse, factory, office	Factory
<b>INPUT STATIONS</b>					
Prepared data input:					
80-column card	80 digits	80 dig. (Mdl. 100)	80 digits	—	Translates spoken, discrete words to character data
Badge, 15/22-column punched	10 digits	10 digits	10 digits	—	codes by encoding analog signal from microphone and comparing with previously recorded patterns by same speaker
Optical wand, bar code	—	—	—	—	—
Transaction codes	No limit	—	10 digits, internal slides	—	—
Fixed data	—	—	—	—	—
Variable data:					
Columnar numeric keyboard	—	—	6, 10, or 16 digits	—	—
10/12-key numeric keypad	16 digits	13 dig. (Mdl. 100)	—	As programmed	—
Alphanumeric keyboard	—	—	—	As programmed	—
Lever switches	—	—	—	—	—
Rotary switches	—	—	Special	—	—
Other types of data entry	Relay contacts	CRT/keyboard; MDTs POS terminals	Clocks, scales, other digital devices	Model 914A CRT/keyboard	—
Operator guidance	Tutorial display via lighted indicators	Tutorial; 36 back-lighted display messages	—	Via CRT	Via display
Data display	16 char.	13 dig. (Mdl. 100)	Columnar keys	1920 char. (CRT)	Yes
Automatic entry clear after transfer?	Yes	Yes	Yes	Yes	Yes
Max./min. message length, digits/chars.	No limit	160(100);384(105)	NA	1920	Variable
Mixed message lengths permitted?	Yes	Yes	NA	Yes	Yes
<b>CENTRAL CONTROLLER</b>					
Model number	SDA-770	Singer System Ten	—	960B	—
Type	Minicomputer	Minicomputer	—	Minicomputer	Minicomputer
Programmable by user?	Yes	Yes	—	Yes	Yes
Storage	32K core; 24M-byte disk	Wide range	—	Up to 128K bytes memory; up to 400M bytes disk	Application-dependent
Time/date	Standard	Optional	Optional in input station	As programmed	As programmed
<b>PRICING AND AVAILABILITY</b>					
Monthly rental (two-year lease, including maintenance);	—	\$950-\$2,000	—	Contact vendor	Contact vendor
Controller	—	\$70-\$160	\$269-\$290	Contact vendor	Contact vendor
Input Station	—	—	—	—	—
Purchase price:					
Controller	\$150,000-225,000 (system)	\$25,924-\$76,775	—	Contact vendor	—
Input Station	—	\$1,845-\$5,000	\$5,725-\$6,425	Contact vendor	\$10,000-\$12,000 per terminal
Date of first customer installation	1970	11/71	NA	1973	9/75
Number installed to date	17 systems	3200 input stations	NA	NA	—
Serviced by	Sierra	Singer	Standard Register	Texas Instruments	Threshold
<b>COMMENTS</b>	Custom and turn-key support available	Model 100 input station is programmable; Model 105 is badge reader	Units punch/print cards and transmit to central computer	System is supported for transaction processing as a stand-alone system in conjunction with central host	Company also markets single-terminal models, including special version for numerical control programming. Company began product deliveries in 1972



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